URANIUM: AN UNCERTAIN MARKET

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by

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URANIUM: AN UNCERTAIN MARKET

Today I will discuss various factors affecting the stability of the uranium market.

"Stability" means different things to different people depending upon their particular vantage points. For my purpose I am assuming that you are interested in stability from the dual standpoints of maintaining a healthy, viable industry for suppliers and an assured continuity of supply at reasonable prices for users.

Many factors contribute to stability, or to instability. Governments play a major role. Mineral economics have dynamic effects. Perceptions cause users and buyers to react differently from one year to the next. Power requirements change. Economies cycle. And uranium is not wholly independent of the world environment for commodities.

I would like to focus my discussion today mainly on how and why the market is behaving as it is. For this reason I will discuss mostly qualitative matters.

Fungibility requires viewing uranium in a world context. Much of my discussion, however, emphasizes the United States. This is partly due to my familiarity with that market; partly because it is the largest of the markets and partly because events there may be forerunners of events elsewhere.

I think it is sometimes helpful when analyzing a complex situation of the type prevailing in the uranium industry to go back into history and highlight key events which have brought us to where we are.

Three Major Events

Three events have been of particular importance:

1. *First*, a series of oil price increases took oil from two dollars to more than thirty dollars per barrel. At first, it had appeared that higher oil prices would strengthen an already healthy nuclear power industry. The opposite proved to be true. One hundred nuclear power plants had been ordered in the US in the six years before the 1973 oil embargo. Within a few years, cancellations and schedule deferrals began. All eight orders placed after 1974 were cancelled or deferred. Nuclear power fared better outside the US, but even there programs have fallen far short of expectations. Orders outside the US dropped from 23 in 1975 to seven in 1978.

Why this watershed in the mid 1970s? Why was it related to oil prices?

For 20 years prior to 1975 the United States had an average increase in Gross National Product (GNP) of four percent. Electrical power had grown seven percent per year. After 1975, GNP grew at an average of two percent per year. Electrical power growth averaged less than three percent per year. The need for new generating capacity of all kinds diminished. Various pressures decreased nuclear power orders more than alternatives.

2. The *second* major event I have called the "de-isolation" of the US uranium market. As you know, the US was isolated by Federal law until 1977, when a phasing down of restrictions began. Current regulations effectively allow the usage of 60 percent imports. The restriction is no longer of commercial significance.

Anyway, the US became increasingly important once it began to interact with the world market. Moreover, market assumptions prevailing at the start of that phase-down gave way to a different set. Back in 1977, the uranium world had different priorities. The US was expected to become a [substantial] net importer because domestic production would not be able to expand rapidly enough. As it turned out, the industry had actually overexpanded. The producer side needed *exports* rather than the user side needing *imports*. An export market might have developed to meet that need had it not been for the third major event.

3. The *third* major event, the discovery of high grade uranium deposits outside the US, made much of the US uranium industry uneconomic. Today the United States can produce only about four million pounds U_3O_8 [per year] at a forward cost of less than $20 per pound; non-US sources can produce over 50 million pounds. The resulting economic readjustment that is still underway has had major consequences for both US suppliers and US users.

Ed. note: **As indicated in Report 168, the US component of Nuexco's estimate of Free World uranium resources reasonably assured at forward costs below US$20 per pound U_3O_8 accounts for 15,000 tonnes U_3O_8, only two percent of the total.**

These three events — declining demand, integration of the US market into the world market, and a shift in economic production locations, account for much of the current turbulence.

I do not, incidentally, include the accident at Three Mile Island (TMI) as one of the three key events. I believe that had the need for electrical power growth continued, the virtues of nuclear power would have

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surfaced more vividly with a higher degree of public acceptance as one result. But that did not happen when the need for nuclear power diminished.

Changing Perceptions

The events I have described are largely those related to concrete aspects of economics. Changes in perceptions are also having a major influence in subtle, less visible ways. Two in particular are important: security of supply and price trends.

Every user is concerned about *security of supply*. Interruption of plant operations, simply because fuel had not been provided for, would be an intolerable embarrassment as well as a major financial loss. How much, and in what form, should one invest to ensure continuity of operations is a crucial question.

Investment emphasis has been shifting. Whereas users focused heavily on U_3O_8 contracts and inventories earlier, U_3O_8 is not now viewed with the same relative importance. Other parts of the fuel cycle are receiving more attention. Because those shifting perceptions determine policy decisions so important to what may happen, I would like to discuss this further. For this purpose I have coined three terms: "horizontal security," "vertical security," and "collective security."

1. *Horizontal security* relates mainly to U_3O_8 supply. One may diversify according to geography, government, company, and so on. Each user determines the necessary mix to accommodate his circumstances.

2. *Vertical security* is concerned with where to invest amongst the fuel cycle choices. Does one achieve more security per investment unit by investing in ore reserves, U_3O_8 inventories, enriched uranium, or fabricated fuel — and in what combinations?

3. *Collective security* relates to the dependence each user has upon others, and they upon him. Each holds an inventory partly for the benefit of others, whether that is the intention or not. The converse is also true. Each inventory holder benefits from others' inventories, government stockpiles, international sharing agreements, and so on. Emergencies require voluntary and forced sharing, just as during the oil embargo.

The user has to put together all the elements of these three components of security — horizontal, vertical and collective — and determine an optimum for his particular situation. The importance of U_3O_8 will change with time and adjustments will be made accordingly.

Generally, the shift has been toward more concern in areas other than U_3O_8. For example, we have seen some non-US utilities diversifying enrichment contracts, some nations providing for self-sufficient domestic fabrication, and so on. At the same time, some utilities have reduced their in-house involvement in U_3O_8 production. Changes in perceptions have a great deal of leverage. Major market shifts can result from relatively small shifts in perception.

The second important perception relates to price trends. A few years back, the consensus was that U_3O_8 prices would continue to rise. Buying early was a small risk or no risk at all. Material would cost more next year. Today, inflation is slowing, interest rates remain high, and spot prices are declining. A loss of 20 to 40 percent in a year may result from buying early or holding after material has been designated for sale.

Uranium and Governments

Governments are important to the uranium industry. Private industry has become involved in the uranium business, but government has never disengaged itself. We do not have the time, nor I the knowledge, to discuss all relevant factors, but several have proved of particular importance in the past and are expected to be of importance in the future.

1. *First*, every major producer nation, with the exception of the United States, has a specific mechanism in place by which government may control prices and production. Whether, and to what extent, that power is used varies, but the means are available.

2. *Second*, governments tend to favor *regulatory* mechanisms over *free market* mechanisms. Governments generally lack the patience to wait for the results of the "invisible hand." Moreover, pressures from their own domestic industries encourage government actions as a political imperative.

3. *Third*, governments have a rapid impact if actions are negative — for example, former President Carter's reprocessing policies. But corrective results cannot be obtained quickly because psychological damage is usually one by-product. Repairing that is a slow process.

4. *Fourth*, antitrust laws have a worldwide influence. US antitrust laws, especially, come under criticism as inappropriate. Those laws, however, are deeply entrenched in American ideology. Substantive change is very, very difficult. I do not believe anyone should expect significant change within the time span of interest.

5. *Fifth*, governments have steadily increased their control over uranium to implement non-proliferation policies. Moral judgments between nations may differ.

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Contracts may exist, but governments feel free, and perhaps even obligated, to unilaterally impose their own standards even though agreements may be breached as a result.

The Market Today

I have discussed thus far a number of important developments which have shaped the current world market. I would like next to discuss some specific features of that market.

Merely to highlight market peculiarities, let me outline textbook economics in its simplest form: a commodity is produced, cost determined, a margin for profit is added, and an offer is made to customers. The customers make their choices. Low cost producers prosper. High cost producers fail.

Against that simplistic theory, consider the following:

1. As of July, 1982, approximately 17,000,000 pounds U_3O_8 were being offered for near-term sale.
2. Of material offered, approximately 90 percent was by *users* — *not* producers.
3. Of the active buyers, 70 percent were *producers* — *not* users.
4. Almost twenty pounds of material was offered for each pound sought by an active buyer.
5. Offering prices were *below the costs* of most producers.
6. World production continues at nearly *double* the rate of actual consumption.
7. Spot market prices have declined more than 50 percent during the past two years.

What we are witnessing obviously does not follow simple, textbook economic theory.

As an aid for an analysis of today's market, I have coined two terms: *use-demand* and *displacement-demand.*

1. *Use-demand* is conventional. Use-demand is needed to fulfill the primary purpose of fueling nuclear power plants. For this purpose, volume is relatively fixed by base-loaded operating plants. Volume does not depend on price. Whether uranium was selling for five dollars or fifty dollars per pound would make little, if any, difference in the rate of consumption by reactors.

2. *Displacement-demand* is demand created by producers' make-or-buy decisions. The lower the price, the more apt a producer is to buy rather than produce. Price must be below production cost, partly to offset non-economic factors encouraging continued operations. The lower the price, the greater the number of producers who find it economic to fulfill contracts by purchase rather than production. Lowering price *does* increase volume in this case.

It makes a great deal of difference to the market which type demand is in control. Displacement-demand controls the spot market price today. As users feel compelled to dispose of excess inventories, prices are being driven to whatever level is required to create enough displacement-demand to allow disposition [of the excesses].

The price influence of displacement-demand reaches beyond the spot market. Numerous long-term contracts are related to "market price." Market price is sometimes equated to the prevailing spot price. In this way, inventory selling is thus controlling some long-term contract prices.

To be more specific, if you were a producer in possession of a long-term supply contract containing a spot market price provision, the prices you would receive for deliveries next year would be those determined by the inventory-seller-dominated secondary market. Those prices probably have little, if anything, to do with the cost of your production or that of your competitors. Because the forces controlling that secondary market have not yet run their course, you would probably look forward to low, unpredictable prices for some time.

How long is difficult to say. My own view is that if world inventories were down to roughly two or three years of actual consumption, and if production rates were within twenty to thirty percent of actual consumption, we might look for return of a more or less normal market quite soon. But world inventories are more than ample for five or six years. Production is roughly double consumption. The supply-demand balance is not improving, but is worsening.

A respected Nuexco client, a US producer, recently commented that he thought everything could be set right if all production would simply stop for two years. Inventories would be reduced; utilities could redistribute; new, rational contracts could be negotiated. Of course, the remark was made in jest, but it does illustrate the problem and the solution.

Long-Term Contract Prices

I have pointed out how spot prices can become long-term contract prices, and how that is working to the discomfort of producers.

An argument is often made that long-term contract prices and spot prices should not be related. The two, it is argued, should not be related either in one's mental processes or in contract terms. However, they can be

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related simply by the process I mentioned — namely, that the long-term market price is equated to spot price.

I doubt that a long-term contract price will ever be published in the same way spot prices are published. A spot price is based heavily on the intrinsic value of uranium. When delivery is to be made immediately, the relationship of the Buyer, Mr. A, to the Seller, Mr. B, is not important enough to change the price significantly.

When the relationship may extend 10 to 20 years and Mr. B, Mr. C and Mrs. D have widely different situations with respect to size of deposits, national origins, capitalization, and so on, then the relationship becomes highly important. Our Buyer, Mr. A, may be willing to grant terms to Mr. B he would not even consider for Mr. C or Mrs. D.

The value of the relationship becomes a major component in a long-term contract. Thus, the long-term contract price reflects not only the intrinsic value of uranium as a material, it reflects the value of a particular match between a particular buyer and a particular seller. A long-term price can be defined, as it sometimes is, as an average of many situations. However, in the final analysis, the result is simply that — an *average*.

Producers' and Users' Dilemmas

All these changing markets, industrial structures and relationships pose dilemmas for users and producers.

Producers have competing interests. They need to sell above cost, but they need to buy below cost. As there is only one spot market price, producers have an insoluble dilemma. It is not unusual in today's market for a producer to buy for an existing contract need and to deliver that purchased material to a utility purchaser who is obligated to accept, but has no current need. The utility may then sell it as excess to another producer.

The result of depressed prices and production cutbacks also poses dilemmas for users. The deeper and sharper the price depression, the higher and sharper an eventual rebound. How to compensate, and when, is not clear.

Commodity and Indices

How is uranium doing relative to other commodities?

Despite widespread belief to the contrary, uranium has not been a volatile commodity with frequent cycling. Uranium sold in the six to eight dollar per pound range for 20 years prior to 1974. Prices rose in 1974, 1975 and 1976 to over forty dollars. That level held for three years. Then the price began a decline which has not yet run its course. Uranium has had only that one aberration so far, but it was major. The aberration covered six years.

For comparison, we might go back to 1970, a few years before the oil embargo, and consider what has happened in the interim. We will compare uranium with four of the world's closely watched indices: the US Consumer Price Index, oil, gold and the Swiss franc.

Uranium sold for a little more than six dollars per pound in 1970. Had uranium maintained a fixed relationship to the Consumer Price Index, it would now be selling for approximately sixteen dollars per pound.

Oil was selling for two dollars per barrel, and is now more than thirty dollars. Had U_3O_8 maintained a fixed relationship, the price would now be nearly $100 per pound.

Because of what happened with oil, an often asked question is whether a UPEC might follow OPEC. We might digress on that for a moment.

An effective OPEC required, apart from government cooperation, that several conditions prevail. The first was a world dependency on oil from the Middle East. The second was a significant US dependency on the same oil. That developed by 1973. The third was that inventories should be small, so that a boycott would create a shortage quickly.

At one time, it appeared that similar uranium conditions might develop. A UPEC was a theoretical possibility. Governments had the means to control export prices. Supply from all major exporter nations was thought *essential*. Many users had small inventories.

Conditions changed. Demand decreased substantially. Inventories mounted for voluntary and involuntary reasons. Supplier nations were no longer *essential*, only *optional*. The conditions which had allowed OPEC to be effective virtually evaporated as far as uranium is concerned. In fact, conditions changed so much that a uranium boycott might even be welcome in some quarters — the US, for example. Producers would be delighted by diminished competition. Utilities could redistribute unbalanced inventories. The US government might even dispose of part of its large stockpile, the purpose of which has become increasingly obscure.

Gold sold for 35 dollars per ounce in 1970, and now is $350. Had uranium maintained a fixed relationship to gold, its price today would be more than sixty dollars per pound.

The Swiss franc doubled in value compared to the dollar. Had uranium maintained a fixed relationship with the franc, it would be selling for approximately

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fourteen dollars.

All in all, uranium has not fared poorly by those comparisons. It gained against the Consumer Price Index and the Swiss franc, and lost against oil and gold. Whether uranium has had relative price stability when other standards are considered is difficult to say. It does appear, however, that uranium is probably no more volatile than much of the non-uranium world.

Summary and Conclusion

Uranium is a commodity whose single purpose makes it captive. Uranium cannot develop a destiny of its own. Creative technological or commercial approaches cannot enlarge the market, as they might with resources such as coal.

The uranium industry is like the core of a system of concentric spheres. Surrounding that core is the nuclear power industry; surrounding nuclear power is the electrical power industry; and surrounding the electric power industry is an economic system. The core cannot change those external environments. On the other hand, those external environments have a critical impact upon the core.

That core, the uranium industry, is undergoing adjustment as stresses build up and are relieved. Early relief cannot be expected to come from the world outside. General economic conditions, slow electrical growth, and nuclear power obstacles continue to exacerbate the problems.

Little can be done by industry or government. Patience is required. Government's regulatory cures, its main weapon, will only shift problems from one area to another. More use-demand, the basic need, is not within the power of industry or even of government to create.

My view is that the best solution will evolve out of a free market. True, there will be continued pain for the supplier, but that pain is unavoidable. Economic forces are so strong that interference would likely be counterproductive. The disarray of the world outside cannot be overcome by regulation.

Using the lessons of history is contingent upon an ability to identify recurring situations. One such series can be identified as over-optimism. We virtually institutionalized over-optimism.

Now the direction is changing. A new danger must be considered.

Current difficulties and those ahead may encourage us to institutionalize over-pessimism. Somehow, we have to focus on the longer pull while traversing the short pull. Achieving stability, I firmly believe, lies in locating and working in that seam of reality between extremes of over-optimism and over-pessimism. If we do so, we shall eventually have a stable, viable producer industry and a confident, satisfied group of users. But the course to reach that goal will not be easy.

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MONTHLY REPORT ON THE URANIUM MARKET

October 1982 No. 170

R. WESLEY MILLER, *EDITOR*

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FOREWORD

Nuexco was saddened by the untimely deaths this month of two unusual men, each of whom played central roles in the development of the uranium industry.

Robert W. (Bob) Adams, Chairman of Energy Fuels, died in New York City on Friday, September 24, at the age of 64. Bob's career in the uranium industry spanned 30 years from prospector to Chief Executive Officer. He founded Western Nuclear Inc., took it public and merged it into Phelps Dodge. Following his resignation from Western Nuclear, Bob started Energy Fuels. Beginning with ore-buying stations, the Energy Fuels operation has expanded to include a number of mines and the new mill in the Blanding, Utah area.

Alaster G. (Al) Swanson, President of Marline Oil Corporation, died in London on Saturday, September 4, at the age of 51. While perhaps not as well known within the international uranium community, Al's contributions had enormous impact. In 1968 he organized an exploration program which ultimately led to the discovery of Rabbit Lake and other now-famous ore deposits in Northern Saskatchewan. In 1971, Al became associated with Pan Ocean Oil, rising to Vice Chairman. In 1976, he became President of Marline Oil, and was a driving force behind the exploration for new uranium districts in the eastern United States. These efforts culminated in July 1982 with Marline's announcement of a large discovery in southern Virginia.

We extend our sympathies to the families and colleagues of these extraordinarily energetic and dedicated men. Bob and Al were true pioneers. They will be missed.

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MARKET ACTIVITIES

PRICING

The **Exchange Value** as of September 30, 1982 is $17.00 per pound U_3O_8, unchanged from last month. During September, the spot and near-term markets were unusually active for the fourth consecutive month. The *Market Data* section lists seven uranium transactions this month, involving a total of 750,000 to 2,000,000 pounds U_3O_8 equivalent.

The market weakened in active trading in the early part of September, only to recover to its initial level in the latter part of the month. There are several reasons for the recent strengthening:

1. A US producer aggressively entered the market and purchased a substantial portion of the material then available for immediate or short-term delivery.

2. Additional utility demand appeared during September.

3. Three aggressive sellers of substantial quantities are now either sold out or very nearly so. The remaining active sellers are not competing so vigorously for sales. For most of this year, the market has been characterized by the willingness of a few particularly aggressive sellers to cut prices as much as necessary to sell their material. However, the mood of the most active sellers in today's market is one of less urgency. Resisting buyers' efforts to extract lower prices, they show less willingness to reduce prices in the hope of stimulating demand.

4. Some US producers and consumers seem eager to believe that the US will enact an import embargo and that it will firm up prices. The prevalence of that belief could be behind some market participants' current behavior.

One caution is in order. The events of recent months have not altered the fundamental imbalance between supply and demand. The phenomenon described here is strictly one of the spot and near-term markets.

Active uranium supply (material offered at competitive prices, terms and other conditions) amounts to 3.3 million pounds U_3O_8 in the near term, nearly double last month's level of 1.7 million pounds U_3O_8. Even after transactions representing more than one million pounds U_3O_8 were concluded during the month of September, *active uranium demand* rose to 660 thousand pounds U_3O_8 as of the end of the month. Therefore, the *supply-demand ratio* declined to 5.0:1.

* * *

The **Transaction Value** as of September 30, 1982 is $17.30 per pound U_3O_8, down $1.80 from a month ago. The current Transaction Value includes 16 transactions totaling 3.2 million pounds U_3O_8 and covers a period of three months. The large drop in Transaction Value is attributable to relatively heavy activity in the spot and near-term markets over the past three months. This month, transactions from May and June, when market prices were substantially higher, dropped out of the Transaction Value calculations.

* * *

The **Conversion Value** as of September 30, 1982 is $1.10 per pound UF_6, up twenty cents from a month ago, but in a very thin market. Active offers to sell conversion services in the near term amount to approximately 1.8 million pounds U, down somewhat from last month. However, *active conversion demand* amounts to only 100 thousand pounds U, last month's active demand having moved into the inactive category. Despite the paucity of activity, there is a consensus that the price required for secondary market transactions is substantially higher than last month.

* * *

The **Loan Use Charge Rate** remained at six percent per annum. Some discussions are taking place and one large transaction remains under negotiation, but the loan market is generally quiet.

AFRICA

Uranium production from Blyvooruitzicht and Harmony (both managed by Rand Mines) increased slightly in the year ended June 30, 1982 to 1,876,000 pounds U_3O_8.

Uranium Concentrate Production During Year Ended June 30 (pounds U_3O_8)

	1982	1981
Blyvooruitzicht	586,000	644,000
Harmony	1,290,000	1,209,000

In his annual statement, Blyvooruitzicht chairman Mr. D.T. Watt noted that "profit from uranium operations was R7.1 million for the year as compared with R12.4 million for the previous year. The decrease was due to rising costs, decreased revenue and slightly lower sales. The latter factor arose from revised delivery schedules specified by the company's customers and

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resulted in an increase of R1 million in value of processed uranium on hand."

He further noted that ". . . the spot price for uranium continued to decline. There are still no clear signs of any revival in the ordering of new nuclear power plants and it therefore appears that there is little prospect of any material improvement in market conditions in the short to medium term . . . [Blyvooruitzicht has] satisfactory contracts for the bulk of the uranium to be produced over the next few years. Unless the company is able to enter into contracts for the supply of uranium at prices substantially better than current market prices, it is likely that the company will cease production of uranium oxide in or about November 1984, at which time the processed uranium stockpile will contain sufficient material to fulfill all outstanding contracts."

Commenting on Harmony, Mr. Watt said, "There is a considerable surplus stockpile of uranium overhanging the market. Much of this surplus material was under the control of utility companies in the US which found the cost of carrying such surpluses to be intolerable at the current high rate of interest. Liquidation of these stockpiles, at prices below the cost of production for many US mines, has been one of the main factors in the continued softening of the market. However, the decrease in the value of the rand against the US dollar has largely offset the drop in US dollar prices and significantly improved the company's uranium revenue in rand terms."

"With . . . the current rate of exchange between the rand and the US dollar, your company expects to continue to enjoy profits from its uranium operation for the next year. In the longer term increased contract prices will be necessary to ensure profitability at current production levels. Failing such price increases, some form of rationalization of uranium production to reduce operating costs may be necessary."

AUSTRALIA

Developers of the Beverley uranium deposit in South Australia (Western Nuclear Australia Ltd., a Phelps Dodge subsidiary, 50 percent; Oilmin, 16.6 percent; Transoil, 16.6 percent; Petromin, 16.6 percent) plan to install a pilot plant next year to test in situ leach techniques. Establishing the pilot operation will cost A$3.4 million. The first commercial unit, approximately twenty times the size of the planned pilot unit, could be installed by 1986 to produce approximately 500,000 pounds U_3O_8 per year.

CANADA

The major topic of discussion in Canada is the US embargo legislation and its potential impact on Canadian producers. However, only speculation is possible at this point, because the detailed language of the embargo enabling legislation has yet to be determined. Although there is certainly irritation in Canada about the prospect of an embargo, any real impact should be minimal as long as existing Canada-to-US sales contracts are honored (grandfathered).

The only sellers in Canada now are the Key Lake partners (SMDC, Uranerz and Eldorado), and Key Lake production is essentially committed through 1985. The embargo could well prompt US utilities to speed up their contracting plans on longer term Canadian supply contracts in order to be included under the grandfathering provision.

Most of the exploration and development plans for new projects in Canada have been reduced or postponed already due to poor market conditions, so the possibility that an embargo might further reduce their market is of little consequence.

There has been some concern expressed in Canada that the embargo could somehow impede the swap of Gulf's Canadian uranium assets for the Eldorado stockpile, but that seems highly unlikely at this point. The deal has been formalized by the parties and is expected to become effective sometime in October. The swap will restore Eldorado's status as a major uranium producer, a state of affairs that had been dormant since Beaverlodge closed.

Aside from some possible uncommitted production from Rabbit Lake, the biggest prize in the transaction for Eldorado would seem to be Collins Bay. The Collins Bay project has not yet been approved by the provincial government of Saskatchewan and no real development work has started. Ore from Collins Bay is expected to begin feeding into Rabbit Lake mill by 1985 or 1986.

EUROPE

In **West Germany**, the relief of the licensing logjam may have come at a most opportune time. The federal government's recent decision to impose a much more restrictive emissions standard on electric utilities could very well increase pressures to build nuclear power plants. It is not yet clear how the new standard will be applied, but utilities are worried that they might be forced to shut down coal-fired generating plants.

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The new standard for sulphur dioxide (SO_2) emissions is less than half the old; the limit of 850 milligrams SO_2 per cubic meter of flue gas was reduced to 400 milligrams per cubic meter. Even more disconcerting to utility executives is the government's stated intention to apply the stricter standard to older, formerly exempted, power plants. Since almost no German coal-fired power plant meets the new standard, many such plants now in operation will probably be forced to upgrade emission controls — at substantial costs — or cease operations. Coming at a time when nuclear power's economic advantage over coal is often called into question, this development should increase pressure to order nuclear power plants and to license and construct those already on order in Germany.

* * *

The Uranium Institute held its seventh annual symposium in London on September 1-3, 1982. Some of the most prominent speakers and the topics on which they spoke are listed below, in the order of their appearance on the program.

Speaker	Organization	Topic
Dr. David Chu	Taiwan Power Co.	Nuclear power generation in a newly industrialized coountry
Mr. Jim Bonny Mr. Murray Fulton	Saskatchewan Mining Development Corp.	The Uranium Equation in 1982
Mr. Hugh Douglas	Hugh Douglas & Co., Ltd.	The merchant uranium market and its effect on price
Mr. Phillip Crowson	The Rio Tinto-Zinc Corp.	Uranium production cost structures
Mr. Bob Wolcott	Nuexco	Uranium: an uncertain market
Mr. Jim Clay	European Economic Coramunity	Past attempts to stabilize other commodity markets
Mr. Ray Livingston	Australian Uranium Export Office	Can market stability be improved? Government and export contract approvals
Dr. Klaus Messer	Rheinisch-Westfalisches Elektrizitatswerk AG	Consumer reaction to Wolcott, Clay and Livingston speeches
Mr. Reginald Worroll	Chamber of Mines, South Africa	Producer reaction to Wolcott, Clay and Livingston speeches

Those who were not fortunate enough to attend the symposium may be able to gain something of its flavor from the following speech excerpts. To obtain copies of the symposium proceedings, please contact The Uranium Institute.

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Mr. David Chu, Taiwan Power Co.	Nuclear power generation in a newly industrialized country

One of the most important factors contributing to our low electric tariff rates is the utilization of nuclear power . . . Nuclear power generation represents 19% of the total power generation in 1980 and 25% in 1981 in Taiwan. . . Moreover, according to our own operating experience, nuclear power generation is not only safe and reliable but also highly economical. . .

. . . nuclear power has a substantial economic advantage over either coal-fired or oil-fired power generation. The total cost of nuclear power generation is only one-third of the fuel cost for oil-fired generation.

. . . Taiwan is very poorly endowed with fuel resources. When additional fuels are needed, our choice is between nuclear and fossil fuels, all of which have to be imported. So far imported oil has made the major contribution to imported energy, which represented roughly 86.38% of the total domestic energy consumption as recently as 1980. And the cost of oil imports was as high as 20.8% of our total export income in 1980.

This is a very unhealthy and risky situation. The remedy should be to change our economic and energy policies from an oil economy to an electric economy. And the key to the success of an electric economy is to maximize the utilization of nuclear power.

Taipower's nuclear power programme consists so far altogether of six units under three projects, each with a twin-unit arrangement. . .

Regarding this programme, a number of features are worth pointing out:

1. Construction management was done by Taipower itself, even for the first Unit. . .

2. . . . Units II-1 and II-2 are the only operating BWR6 units in the world, even though several other BWR6 units started construction earlier than ours.

3. The construction costs appeared to be reasonable, and this has led to the attractive electricity production costs . . .

4. We found the twin unit approach a very beneficial one. The experience obtained from the First Unit can immediately be applied to the Second, while memories are still fresh. Spare parts for the second unit can be readily made available for the first unit. The construction force for two units is only about 1.5 times that for a single unit, because people can work on the second unit when they are not busy on the first. . .

Taipower believes that nuclear power technology today is not yet fully mature. We therefore initiated a betterment programme for our completed nuclear power projects, immediately following the handing over of the units from the construction people to the operation and maintenance group. The betterment programme pays off handsomely, resulting in improved availability and capacity factors for the facilities. . .

Looking ahead into the future

It is essential that our serious energy problems should be solved effectively. Like many other countries, Taiwan will continue its Light Water Reactor Programme up to the turn of the century. The technology is proven. Its relative economy, as compared to fossil fuel power generation, has been well established. It is the best way of escaping from the difficult consequences of the prolonged oil crisis.

The volatility caused by economic constraints and perceptions is reinforced by the other major cause of instability, uncertainty. . . Changing economic conditions, evolving patterns of industrial activity, and shifting population, make it impossible for utilities to forecast accurately future electricity needs, particularly in view of the long lead times involved. Changes in government licensing requirements, improvements and changes in engineering design, and other technological factors add to the uncertainty.

. . . Uranium exploration is still as much an art as a science; and even when deposits are discovered, there still remains a great deal of uncertainty about the size, grade and nature of the ore body until detailed drilling or, in some cases, experimental mining has occurred. The development process is also uncertain, with changing government and environmental regulations and technical difficulties often extending development lead times.

. . . Decisions often have to be revised in the light of new economic forecasts, demand projections or ore reserve values; while actual results may be very different from those predicted . . . The result is that inequalities invariably develop between supply and demand, no matter how careful the planning and coordination may have been. . .

Historically, supply and demand in the uranium market have been almost continually out of balance . . . Over the period 1970 to 1981, supply has consistently exceeded demand, leading to a continued increase in inventories . . .

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. . . relative inventories have, in general, increased significantly since the early seventies from a level of 2.6 years to over 4 years.

The changes which have occurred in the level of relative inventories correlate quite well with uranium market developments during the seventies. This confirms that the level of relative inventories is interrelated with the volatility displayed by the uranium market.

The uranium market to 1995

Using the above analysis as a basis, what can be expected looking forward to 1995?

Changes in the level of uranium utilization are indeed likely as the uranium market develops. . . utilities with enrichment contracts in the United States are already taking advantage of the flexibility in their contracts to change the tails assay. . .

. . . inventories of enriched uranium will grow substantially over the next five years or so because of the contracts utilities already have with enrichment facilities. Some market commentators have assumed that this will not lead to lower natural uranium demand, because utilities will continue to need natural uranium to supply their enrichment uranium, a commodity that so far has not had a ready market. However, while this may have been the case up till now, secondary markets are beginning to develop for SWUs. In this way some enriched inventories will be redistributed, thereby reducing primary uranium demand. The pressure for such transactions comes from the high cost of holding enriched inventories, and the transactions are facilitated by flexibilities in enrichment contracts. While this increased fluidity of inventories could be disruptive of the market in the short-term, it could have long-run benefits by hastening the balancing of supply and demand.

Bob Wolcott, Nuexco — **Uranium: an uncertain market**

Mr. Wolcott's speech was reprinted in its entirety as an Insert to Nuexco Report 169 of September, 1982.

J.A. Clay, European Economic Community — **Past attempts to stabilize other commodity markets**

The general idea behind attempts to stabilize commodity markets is . . . the wish to avoid widely fluctuating prices — which on the whole make life difficult . . . for miners, . . . for consumers, and for governments . . .

. . . political action and the activities of commodity markets mix extraordinarily badly. Moreover, if the political action is . . . international, then matters are . . . usually worse.

. . . the basic economic theory underlying commodity market operation is by no means clear-cut or agreed. This means that widely differing concepts and policies can surface at the national policy level, and can change radically at the same national level when new people get involved. . .

Then the basic mechanisms of the various commodity markets . . . are not easily understood by civil servants . . . and very few politicians have made the grade at all. . .

. . . What, then, are people trying to do when they propose to stabilize commodity markets? Are they really trying to keep prices stationary; or stationary after allowing for inflation; or fluctuating to a *small* degree around their average, etc. . . . As a final comment on political attitudes to commodity market problems, I would say that a judgment . . . such as: "our aim is to secure adequate supplies of copper (or any other commodity which is traded on world markets) at prices remunerative to producers and fair to consumers" is a poor way of stating the problem; it is light-years away from hinting at anything in the nature of a solution.

Let us . . . pass on to the practical commercial and economic problems of stabilizing commodity markets. One way is to stabilize the price in various ways when a particular LDC (less developed country) suffers from low world prices or from some national disaster involving transport or other investment facilities. . .

Another approach, to [reduce] . . . the output from producers, is what the classical free-market is supposed to produce of its own accord. It still does to a considerable extent in North America, . . . but this market discipline hardly operates . . . where governments require their mining and smelting industries to produce more, not less, in the face of falling prices in order to maintain export income. . .

. . . some are tempted by the idea that a meeting could fix a fair price if only producers' costs could be revealed. . . . this, . . . is a blind alley. . . while all kinds of items can find their way into costs, the most obvious interloper . . . is local taxation, which is simply the number the Minister of Finance last thought of. Costs are indeed relevant; but they operate through the market's supply curve.

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In general the market produces in the short term a market clearing price at any given time, and there is great merit in this. What the market does not do is to compensate for the basic problem of the world commodities — namely, that supply is rather inelastic. . . you cannot open a mine in 12 months; but you also cannot quickly and easily reduce production when the market weakens. . .

Tin is the only metal which is subject to an intergovernmental commodity scheme designed to stabilize its price. . .

Among the "soft" commodities there are intergovernmental schemes covering coffee, cocoa and rubber. . .

Conclusion

. . . Given that many government and inter-government schemes to stabilize commodity markets have failed, and given that many industry schemes are now likely to be illegal in one country or another, what should our policy be?

The fundamental problem is still the inelasticity of supply. The basic possibilities, therefore, are, first, some restriction of supply (either production or exports) in times of recession, in order to avoid over-reaction of price and unnecessary closing of capacity. This restriction of supply is a painful process, but not so painful as what happens if no action is taken. . .

Another contribution to the problem would be the setting up by any consumer government of a national buffer stock, which would be used to purchase supplies when prices were low, and to sell to its own nationals when prices were high, on any price and quantity basis which seemed good to that government. No coordination (beloved of international civil servants) would be needed or desirable, and the more governments that followed the idea in their own private way, the better. Under such a system surpluses could well be taken off the market when desirable, and stocks returned to the market when deficits began to appear. Such a scheme would put considerable pressure on governments, one would hope, to get good market advice from their own traders, producers and consumers.

Jim Bonny and Murray Fulton, Saskatchewan Mining Development Corp.

The Uranium Equation in 1982

A year ago, when the Institute's Supply and Demand Committee reported to this Symposium on its second supply and demand report, the comment was made that since the initial report appeared in 1979, conditions in the uranium market had radically changed. Now, a year later, conditions are still changing. Estimates of forecast nuclear generating capacity have been further reduced, resulting in lower estimates of uranium requirements. Production cutbacks continue to be announced, reflecting perceptions that price recovery will not be immediate, and that unfilled short-term demand is vanishing. Inventory levels have increased, despite selling efforts by some utilities on the spot market. Finally, spot uranium prices have taken another dramatic move downward, following a period of stability (in current US dollar terms) during the latter half of 1981.

. . . an update of the supply and demand estimates . . . form(s) the basis for Part I of this paper, which is presented on behalf of the Supply and Demand Committee. Part II, which discusses certain perspectives on these forecasts, gives the personal views of the authors.

Part I: The Uranium Balance — 1982 compared with 1981

. . . Continued cancellations and deferrals of reactors, combined with few new orders, account for the reduced forecasts of nuclear generating capacity in the years to 1995.

. . . In the period prior to 1987, uranium requirements remain essentially unchanged from the 1981 forecast, even though generating capacity is forecast to decline. The reason is the delay in bringing reactors on stream which had been originally planned for pre-1985; they now fall into the period 1985-1988. The first cores associated with these reactors result in *increased* uranium requirements relative to forecast capacity.

On the supply side, changes have also occurred . . . Most noticeable is the increase in production capability from operating facilities, as projects have moved from the construction phase to the operating phase. This increase ranges from 2600 tonnes U (6%) in 1982 to 5600 tonnes U (15%) in 1990, and is due to the coming on stream of Ranger (Australia), the attainment of full operation by Cluff Lake (Canada), and increases in productive capacity in France, Gabon and South Africa. Canada and the United States show a net reduction in productive capacity, as a result of announced cutbacks and shutdowns; these have taken place throughout the United States, while in Canada two mines have shut down their operations.

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The combined capacity of production facilities operating and under construction has decreased slightly relative to the 1981 forecast. The broad picture is that production capacity has been reduced by 1500 to 2000 tonnes U, suggesting that while severe cost pressures have reduced actual production, particularly in the US, there has not yet been a substantial reduction in production capacity . . . However, no new mines have entered the construction phase.

. . . For producers, cash flows have been reduced due to weak markets in all minerals, including oil and gas, as well as uranium. This, combined with high interest rates and high inflation, has led to cuts in production and exploration and to delays in development. . .

. . . Actual production will differ from (production capacity) to an extent depending on the actual cost/price relationship, contract commitments, and other such market factors.

Despite all these changes, the main conclusion from last year's report, namely that sufficient production capacity will be available to supply the *existing* reactor programme at least until 1995, still holds. . .

Part II: A perspective on the uranium equation

. . . the changes which are continuing in the uranium market, . . . highlight what has long been known: that the market is extremely volatile. Part II analyzes this underlying volatility; comments on the significant impact of stockpiles; and concludes with some observations on how the instability might be minimized.

Economic factors

. . . worldwide exploration expenditures on uranium have historically been influenced by the state of the uranium market, as represented by the constant dollar spot market price (i.e., the Nuexco Exchange Value). Such changes in activity almost invariably lead to results that are dramatically different from those foreseen in even the most rational of plans. The result is market volatility, for under such conditions it becomes highly unlikely that supply will equal demand.

While market forces serve to bring supply and demand into balance, conditions have often changed by the time they act, thereby stimulating new and different influences. . .

. . . The average lead time for uranium mines brought into production before 1960 was about five years. For mines brought into production after that date, the average lead time has been . . . in the range of 10-25 years. The average lead time for reactors in the western world has been approximately eight years, with a normal distribution around this figure. The average lead time for the United States has also historically been eight years: although, in contrast, the anticipated average lead time for reactors now under construction is 10-12 years.

R.S. Livingston, Australian Uranium Export Office

Can Market Stability be Improved? Government and Export Contract Approvals

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Detailed price information relating to deliveries under long-term contracts has been difficult to obtain in the past; whereas spot-price indicators have been published for years by Nuexco and Nukem. One of the consequences of the lack of price information in the long-term market is a tendency by the industry to focus on the spot-price indicators and to refer to them as barometers of the total market. While this tendency is understandable in the absence of other readily available data, it is desirable to make some cautionary observations on the growing pressures on producers to use these spot-market indicators for pricing purposes under long-term contracts, particularly in the US market.

At the time of drafting this paper, the Nuexco Exchange Value had fallen to $19.25. There is no doubt in my mind that adoption of this price for the bulk of their deliveries would place almost all producers in the fast lane to bankruptcy, and would foreclose on most future projects, with predictable consequences for long-term supply and industry stability.

This is not to imply that the spot market is irrelevant. . . . but it must be recognized that its role is limited. We can all accept that there is a price which will equate long-term supply and demand; but there is no compelling reason for believing that spot prices at a particular time bear any relation to that long-term equilibrium price.

We believe that the wide adoption of spot prices is incompatible with the objective of long-term stability. We view with concern recent developments in the US market, which appears to be more directly influenced by spot prices than markets elsewhere. The industry in that country seems to be reacting to typical 'boom/bust' conditions, an extremely inefficient and costly process for producers and consumers alike.

. . . commodity markets . . . are nearly all subject to substantial price fluctuations, due in the main to the fact that marginal supply surpluses or shortages tend to have a disproportionate effect on prices on the relevant commodity exchanges. . .

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. . . it can be argued that the instability of the relatively new commercial uranium market has been due to rather special circumstances which should not be repeated in the future.

. . . after the 'shake-out' over the past few years construction programmes are firmer, with a more realistic and predictable reactor and enrichment demand over the balance of the decade.

In the circumstances it seems reasonable to conclude that there will be a growing and largely predictable demand for uranium over the next decade or so, which will be mainly uninfluenced by movements in prices. . . There will be differences of opinion as to the long-term equilibrium price; but the parameters of disagreement may be much narrower than is commonly thought.

The import embargo imposed by the USA in 1964 (not yet entirely removed and further restraints threatened) would be described by most objective observers as both misguided and hardly calculated to encourage the development of an efficient and stable international uranium industry.

The export embargoes imposed by the USA and Canada in 1977 did nothing to inspire confidence in the security of contractual relations between producers and consumers. An unfortunate aspect of these actions was the attempt to apply retrospectively new conditions to trade under existing contracts.

A major objective of our export control policies is to ensure that, . . . Australia receives a fair and reasonable return for sales of its resources. . .

With regard to uranium, this common policy objective translates into a requirement for contracts to provide for fair market prices to be received over their duration. Such prices are negotiated between buyer and seller, and should have proper regard for long-term factors and keep short-term factors in perspective. Such an approach should result in market prices more consistent with the 'economic incentive' price which the Institute's own analysis has concluded is an essential prerequisite for a balance of supply and demand over the longer term. We see this approach as one which contributes significantly to stability and orderly development in resource industries.

. . . However, in view of the volatility which has, at least to this time, characterized the uranium industry, it was considered appropriate to underpin this more general objective with a requirement for a floor price mechanism.

Reginald Worroll, Chamber of Mines of South Africa — **Producer Viewpoint relative to Market Stability**

1. . . . while the instability in the uranium market affects both producer and consumer, it is the producers who, for the most part, have to withstand the pressures which such instability brings about. . . As I see it, it is the lack of stability in the demand side of the equation which is the prime cause of the problem. . .

2. The uranium mining industry cannot survive without the nuclear power industry and without uranium mines there would be no nuclear power. . . the industry should be able to introduce into the arrangements under which trade in uranium is conducted policies and practices which may not be feasible in other areas of commercial activity.

3. The answer we are all seeking is where do we go to find the key to the stabilization of uranium prices? . . . I am not encouraged by what Mr. Clay has told us — producer prices, buffer stocks, export quotas, and the like, are not likely, if the experience elsewhere is any guide, to be as successful as one might hope.

4. While I claim to be an exponent of free enterprise, I hesitate to subscribe, without reservation, to the view expressed by Mr. Wolcott "that the best solution to market stability will evolve out of a free market." He warns that there will be pain for the supplier and that the pain is unavoidable. You will understand that as a supplier I find it a little difficult to accept this conclusion with equanimity. I think we should strive to find something to relieve the pain when the going gets rough, at which time also the suppliers will need the help and understanding of their trading partners, the utilities.

6. The difficulty of specifying in advance a fair and reasonable price for uranium under a long-term contract has been borne out by our experiences in the past. . . Because of these difficulties the market concept has come to be applied on a fairly wide scale. By this means the parties are able, by negotiation, to determine a price, usually on an annual basis, which is considered to be consistent with current market conditions resorting; in the event of disagreement to the determination of a market price by an independent arbitrator or expert. . . Unconsciously, perhaps, we have also developed a tool which I believe could be used on a broader basis given good faith and understanding between the contracting parties to cushion the shocks transmitted by an unstable market.

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7. This would be a fundamental change in the market price concept and it would not be appropriate to continue to describe it as such. Rather, it becomes a "negotiated price" arrived at not only on the basis of an assessment of prevailing market conditions, but having regard also to other, possibly subjective, factors which the parties consider it necessary or desirable to take into account. Under this kind of arrangement there might not be much room for arbitration in the event of disagreement, since an arbitrator would find it difficult to adjudicate on subjective factors in the minds of the parties. This difficulty can be overcome and at the same time a measure of discipline can be added to the negotiated price concept by the adoption in conjunction with it of a floor price and a ceiling price each pitched at a level designed to protect the legitimate interests of the parties; and at the same time to provide an effective brake on price instability.

8. . . . The concept is simply enough. Its translation into practice may be somewhat more difficult, but I firmly believe that where producers and consumers are ready to come together under long-term supply contracts the concept is feasible and workable. . .

UNITED STATES

Two US producers received licenses for uranium mills:

1. Pioneer Uravan received a license for its planned Slick Rock, Colorado mill. Pioneer has no current plans for developing the mill, preferring to wait for an improved uranium market.

2. The Seboyeta, New Mexico mill, part of the Sohio Western Mining Company (Sohio) L-Bar Ranch uranium operation, was relicensed for an additional 5 years, although it is presently closed.

* * *

Sohio and Reserve Oil & Minerals Company (Reserve), originally joint venture partners in the L-Bar Project, have resolved their differences in a complex settlement under which Sohio became the sole owner of the mine, mill and U_3O_8 inventory, assumed certain of Reserve's debts, and forgave certain amounts owed to it by Reserve. Other considerations included cash payments, and transfers of land, royalties, surface and mineral rights. Sohio has no plans to operate the mill until the market improves.

* * *

South Carolina Electric and Gas Company began loading fuel for its Summer nuclear unit, with hopes of commercial operation by year end. Five utilities have received operating licenses for nuclear units so far this year:

Utility	Reactor	License
Commonwealth Edison Co.	LaSalle Unit 1	Full power
Pennsylvania Power & Light Co.	Susquehanna Unit 1	Low power
Southern California Edison Co.	San Onofre Unit 2	Full power
Mississippi Power & Light Co.	Grand Gulf Unit 1	Low power
South Carolina Electric & Gas Co.	Summer	Low power

These units represent approximately 5,400 MWe of generating capacity. The corresponding increase in US consumption of U_3O_8 is on the order of two million pounds per year.

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MARKET DATA

URANIUM SUPPLY

Nuexco Reference Number	Delivery Period[1] (Thousands of Pounds U_3O_8) 0 to 1 Year	Beyond 1 Year	Remarks
Available for Sale:			
ACTIVE			
1575		500 per year	Long Term
1610	50		
1920	2,000		
1925	500		UF_6
1932	200		
1970	40		UF_6
1976	180		
1986	40		
2009	50		
2014	250		
TOTAL:	3,310		
INACTIVE			
1581B		100 per year	Long Term
1774	50		
1804	615		
1805		500 per year	Long Term
1818		250 per year	Long Term
1877	50		
1928	1,000		UF_6
1951	1,250		
TOTAL:	2,965		

[1]Measured from the date of this Report

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URANIUM DEMAND

Nuexco Reference Number	Delivery Period[1] (Thousands of Pounds U_3O_8)		Remarks
	0 to 1 Year	Beyond 1 Year	
Inquiries to Purchase:			
ACTIVE			
1638		250 per year	1983-89
1843	250		
1871		250 per year	1983-86
1915		500	UF_6
2004	100		
2005		1,000	
2009	50		
2010		400 per year	1984-92
2014	160		
2020		300 per year	1984-93
TOTAL:	660		
INACTIVE			
1459		200 per year	Long Term
1652		200 per year	Long Term
1888		500 per year	Long Term
1923	30		
1935		400	
1963		180	
1966	100	200	
1978	200	200	
1979	30	175 per year	1983-87
1995	300		
1996		420	
1999		50 per year	1985-90
TOTAL:	660		

[1]Measured from the date of this Report.

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CONVERSION SUPPLY

Nuexco Reference Number	Delivery Period[1] (Thousands of Pounds U as UF6) 0 to 1 Year	Beyond 1 Year	Remarks
ACTIVE			
1609	500	1,500 per year	Long Term
1925	450		
2008	800	800	
TOTAL:	1,750		
INACTIVE			
1619	250	250	
1902			
1936	200	350	
1983	415	200 per year	Long Term
TOTAL	865		

CONVERSION DEMAND

Nuexco Reference Number	Delivery Period[1] (Thousands of Pounds U as UF6) 0 to 1 Year	Beyond 1 Year	Remarks
ACTIVE			
2018	100		
TOTAL:	100		
INACTIVE			
1594	400	450 per year	Long Term
1622	250	700	
TOTAL:	650		

[1]Measured from the date of this Report.

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LOAN SUPPLY AND DEMAND

Nuexco Reference Number	Delivery Period[1] (Thousands of Pounds U_3O_8)		Remarks
	0 to 1 Year	Beyond 1 Year	
Available for Loan:			
ACTIVE			
1815	1,000		
1884	275		
1938	2,000		
1939	800		
TOTAL:	4,075		
INACTIVE			
1910	1,000		
1919	2,000		
1931	600		
TOTAL:	3,600		
Inquiries to Borrow:			
ACTIVE	None		
INACTIVE	None		

[1]Measured from the date of this Report

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CURRENT TRANSACTIONS[1]

Uranium Transactions

Nuexco Reference Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as Percent of Current E.V.	Seller	Buyer	Remarks
1943	1982	51-100	100	US Producer	US Producer	
1950	1982	101-300	Less than 99	US Utility	US Producer	
1953	1982	Less than 50	99	US Producer	US Producer	
1959	1983	101-300	Less than 99	US Utility	US Utility	UF_6
1962	1982	101-300	Less than 100	US Utility	Unknown	UF_6
1965	1982	301-600	Less than 99	US Utility	US Producer	Some UF_6
1966	1983	101-300	99	US Utility	US Utility	

Conversion Transactions

Nuexco Reference Number	Delivery Period	Approximate Quantity (thousands of pounds, U equivalent)	Approximate Price as Percent of Current C.V.	Seller	Buyer	Remarks
1946	1983	101-300	91	US Utility	US Utility	
1967	1983	Less than 50	77	US Utility	US Utility	

[1] Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.

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COMMENTARY

THE US URANIUM IMPORT EMBARGO ISSUE

Summary

The prospects for a US uranium import embargo are highly uncertain. Final consideration of the proposed legislation has been deferred until the post-election session of Congress. Consequently, the next six to eight weeks are of most immediate interest. It is Nuexco's opinion that most, if not all, potential US buyers of uranium will await further developments rather than risk contracting long-term for *any* uranium in the current circumstances.

The entire issue is characterized by uncertainty. It is not even clear that the proposed measure, if enacted, would provide the desired benefits to US producers. In Nuexco's opinion, the outlook would be for continued uncertainty if the measure were passed, because its commercial effects would depend on how and by whom it were administered. The result would be a continuing planning nightmare for US utilities and producers.

Status of Legislation

The prospects for US passage of meaningful uranium import embargo legislation remain highly uncertain. During September, a House-Senate conference committee adopted a measure designed to limit US imports of uranium to 37.5 percent of actual or projected domestic uranium requirements. However, several influential members of the House of Representatives have since announced their opposition to the measure. Several members even sent a letter to other Representatives in which they opposed the measure, primarily on the grounds that it would adversely affect US foreign relations. There is also speculation that President Reagan would veto any such legislation. Final consideration of the embargo measure by the House of Representatives has been deferred to the post-election session of Congress, so the next six to eight weeks are of most immediate interest.

Effect on Procurement Strategy

Uncertainty over whether an embargo will be enacted and, if enacted, what the ultimate effects will be make it very difficult for producers and utilities to plan their marketing and procurement activities. The dilemma faced by each potential buyer of uranium — whether to execute a purchase contract at the present time or to await future developments — is particularly acute now that an embargo is so close, yet so far away.

Consider three possible courses of action:

1. A US utility could execute within the next six to eight weeks a long-term contract for the purchase of relatively low-priced Canadian uranium. A utility executive could argue that now is the time to buy, since contracts executed before passage of the embargo legislation would be honored (grandfathered). However, there is always the possibility that any import restrictions would somehow be applied to all utilities, regardless of when their import contracts were signed. Therefore, such a course of action would not be risk-free.

2. A US utility could execute within the next six to eight weeks a long-term contract for the purchase of relatively high-priced *US origin uranium*. A utility executive could argue that, since other US utilities would be forced by the embargo to buy US uranium, he could obtain the lowest price for domestic supplies by buying now. This strategy carries the risk that no meaningful embargo will be enacted. If so, the utility would have needlessly obligated itself to pay more than the spot market price for uranium deliveries, something they are generally reluctant to do.

3. A US utility could await further developments. If no meaningful embargo is passed, a utility will still be able to buy uranium under terms and conditions similar to those of the current market. The fundamental aspects of supply and demand will not alter drastically in the next six to eight weeks. If a meaningful embargo is passed, then a utility will have ample justification for paying whatever price is necessary to acquire the needed uranium. In either case, this strategy is virtually risk-free and, in Nuexco's opinion, is likely to prevail in the ensuing weeks.

What If the Proposed Measure is Enacted?

Even if the proposed embargo legislation became law, it would still be rife with uncertainty; for example:

1. The final language is not yet known. Although a text has been released, the legislators' staffs were given authority to make editorial changes for the purpose of clarification. Given the ambiguous wording of so much of the embargo measure, "editorial changes" could very well change the substance of one or more provisions, intentionally or otherwise.

2. The proposed language refers to "executed contracts," but it does not mention *when* a contract would have to have been executed in order to qualify for grandfathering.

3. If, at any time, the Energy Secretary determined that executed contracts or options for imports of foreign-source uranium represented more than 37.5 percent of actual or projected domestic uranium require-

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COMMENTARY

ments for any two-consecutive-year period, then the Secretary would be required to "immediately revise criteria" for USDOE enrichment services to enhance the use of domestic origin uranium. It has yet to be determined how the 37.5 percent limit would be measured. Furthermore, it is unknown what actions the Secretary might take to "enhance" the use of domestic uranium.

4. It would require the projection of numerous industry measures, such as:

a. uranium requirements and inventories of domestic utilities;

b. present and future uranium production by the domestic mining and milling industry;

c. present and future probable penetration of the domestic market by foreign imports;

d. the size of domestic and foreign ore reserves;

e. present and projected domestic uranium exploration expenditures and plans;

f. present and projected employment and capital investment in the uranium industry, etc.

None of the projections listed above would be simple. The assumptions used in each analysis would be critical. Respected analysts could easily reach diametrically opposed conclusions. Therefore, the conclusions would be subject to manipulation by whoever was chosen to perform the analyses, and also by the administration. What purported to be objective reports would become instruments of political policy.

5. Industry-wide measurement of the chosen criteria would make individual utility planning practically impossible. A uranium import contract signed at one time might help to trigger the 37.5 percent limit at some later date. Furthermore, the time lags inherent in the system for reporting and administration would make contracting much more uncertain.

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ESSAY

THE FUTURE OF THE US URANIUM PRODUCTION INDUSTRY

The continuing viability of the US uranium production industry is essential to US utilities' desire for assured future supplies of *domestic* uranium. However, for the past several years, they have been struggling with the choice between two mutually exclusive alternatives:

1. To obtain security of domestic supply by agreeing to long-term contract prices which are high enough to ensure that viability;

2. To obtain relatively low-priced material by relying more on the spot market, but at the cost of accepting greater market uncertainty and the risk that spot prices may rise suddenly.

Unfortunately for many US uranium producers, US utilities have often chosen the second option, with its resulting short-term downward pressure on spot prices.

The conventional relationships between supply and demand are but one aspect of today's uranium market. Beginning in 1980 and continuing to date, utilities liquidating inventory in competition with producers selling uncommitted production have exerted enormous pressures on the spot and near-term markets. While utility inventory sales have eased somewhat of late, recent reactor cancellations and deferrals suggest that additional such sales are inevitable, and will continue to compete with primary supply and maintain pressure on prices in the spot and near term.

This perceived availability of material, together with the forecasts that worldwide supply will continue to exceed consumption through 1990, suggest the continuation of a buyers' market for some time. US utilities in particular are reluctant to enter into long-term contracts that are not related to spot price. Their experience with contracts having base-escalated prices in the mid and late 1970s (some current delivery prices are more than triple the current spot price) has made them extremely cautious.

Producers, particularly those higher cost US producers, require, on the other hand, prices related to or in excess of their variable production costs. In many cases, current spot price levels will not suffice. Only perceived shortages (unlikely) or higher prices for long-term supply will allow these producers to survive. Even though currently worked reserves are being depleted and shut down, little new uranium development can be expected in the US without new high-grade finds.

Table 3 is a list of currently operating US uranium mills and their nominal capacities. Some of those listed have already announced shutdowns by year end 1982 or for 1983. In addition, at least two others are considering or have actually initiated open market purchases, perhaps in anticipation of shutting down or cutting back production.

The US uranium industry is near the end of its second price cycle. The industry is in contraction resulting from decreased demand, weak prices, and competition from its own customers. Eventual price recovery appears likely, but the timing is far from certain. If market participants can learn enough from the painful lessons of the first two price cycles, it should be possible to avoid over-contracting and, in so doing, reduce the likelihood of still another cycle of boom and bust.

Table 3

1982 OPERATING US URANIUM PRODUCERS NOMINAL PRODUCTION CAPACITY
(thousands of tons per day)

Mill	Capacity
CONVENTIONAL	
Atlas Minerals Corp.; Moab, Utah	1,400
Chevron Resources; Panna Maria, Texas	2,500
Cotter Corp.; Cañon City, Colorado	1,200
Dawn Mining Co.; Ford, Washington	500
Energy Fuels; Blanding, Utah	2,000
Exxon Minerals; Powder River, Wyoming	3,200
Homestake Mining Co.; Grants, New Mexico	3,400
Kerr-McGee Nuclear; Grants, New Mexico	7,000
Union Oil; Sweetwater, Wyoming	3,000
Pathfinder Mines Corp.; Gas Hills, Wyoming	2,500
Pathfinder Mines; Shirley Basin, Wyoming	1,800
Petrotomics Co.; Shirley Basin, Wyoming	1,500
Rio Algom Corp., La Sal, Utah	750
Rocky Mtn. Energy; Bear Creek, Wyoming	2,000
Union Carbide Corp.; Uravan, Colorado	1,300
Union Carbide Corp.; Gas Hills, Wyoming	1,400
Total Operating Capacity – Conventional	35,450

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ESSAY

1982 OPERATING US URANIUM PRODUCERS
(thousands of pounds U_3O_8 per year)

Mill	Capacity
UNCONVENTIONAL	
Solution Mining:	
Caithness Corp.; Bruni, Texas	250
Conoco; Treviño, Texas	400
Everest Mineral Corp.; Las Palmas, Texas	250
IEC Corp.; Ray Point, Texas	250
Nufuels Corp.; El Mesquite, Texas	700
Nufuels Corp.; Ohern, Texas	200
Ogle Petroleum; Bison Basin, Wyoming	400
Tenneco; West Cole, Texas	300
Uranium Resources Corp. (URI); Bruni, Texas	100
URI-Framco-Conoco JV; Benavides, TX	400
US Steel Corp.; Burns Ranch, Texas	1,000
US Steel-NM Uranium; Clay West, Texas	1,000
Phosphoric Acid By-Product:	
Earth Sciences, Inc.; Calgary, AL	120
Freeport U. Recovery Corp.; Uncle Sam, LA	750
Freeport U. Recovery Corp.; Sunshine, LA	420
IMC Corp.; New Wales, Florida	900
IMC Corp. @ CF Industries; Plant City, FL	650
IMC Corp. @ CF Industries; Bartow, FL	650
Heap Leaching:	
Anamax Mining Co.; Sahuarita, Arizona	140
Wyoming Mineral Corp.; Bingham Canyon, UT	125
Total Operating Capacity—Unconventional	9,005

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MARKET ANALYSIS

US INVENTORY COMPOSITION

DOE's July 1982 "Survey of United States Uranium Marketing Activity" indicates a change in US uranium inventory position seemingly inconsistent with Nuexco's previously published analysis. Table 2 below, based on DOE data, indicates inventories held by "ALL BUYERS" actually declined last year.

Table 2

URANIUM INVENTORIES HELD BY US BUYERS
(millions of pounds U_3O_8 equivalent)

	ALL BUYERS		UTILITIES	
	As of 1/1/81	As of 1/1/82	As of 1/1/81	As of 1/1/82
Natural Uranium	90.2	102.4	75.4	88.2
Enriched	36.6	22.4	33.4	17.4
TOTAL	126.8	124.8	108.8	105.6

Nuexco Report 159 of November 1981 forecast a US supply excess — Production minus Consumption minus Net Exports — of 14.5 million pounds U_3O_8 equivalent. Since buyer inventories actually declined by 2.0 million pounds U_3O_8 equivalent, there is an apparent inconsistency of 16.5 million pounds U_3O_8 equivalent between Nuexco's forecast and the DOE data.

Two factors account for virtually all of the difference:

1. Producer inventories increased;
2. Fabricated fuel inventories increased.

Historically, producers have milled little beyond what was needed to fulfill contractual commitments and to make some spot sales. It has only been in the last few years that producer inventories have become a noticeable part of the total. Incorporating producer inventories into Table 2 yields Table 3, showing US *commercial inventory* at the beginning and end of 1981.

Table 3

US COMMERCIAL URANIUM INVENTORY
(millions of pounds U_3O_8)

	As of 1/1/81	As of 1/1/82
Natural Uranium		
All Buyers	90.2	102.4
Producers	5.4	14.0
Enriched Uranium	36.6	22.4
TOTAL Commercial Inventory	132.2	138.8

Table 3 indicates US producer inventory increased by 8.6 million pounds U_3O_8 during 1981. As a result, US commercial uranium inventory increased by a net of 6.6 million pounds U_3O_8 equivalent, leaving 7.9 million pounds still unaccounted for.

Thus, increases in producer inventories account for approximately half of the difference. The remainder is attributable to increases in inventories of fabricated fuel:

1. Nuexco's inventory estimates customarily include ". . . uranium (U_3O_8, natural UF_6, enriched UF_6) owned by utilities, reactor manufacturers, fuel fabricators and national organizations which procure uranium for commercial purposes.

2. An important assumption used by Nuexco in calculating Apparent Future Consumption (AFC) is that ". . . U_3O_8 deliveries for first cores predate commercial operation by two years."

3. Nuexco's estimate of 1981 consumption included fuel for operating reactors as well as that going into the pipeline for three first cores. The NRC estimate of schedule for issuance of operating licenses listed 17 reactors which could receive an NRC operating license in 1983.

4. Applying Nuexco's AFC assumption to each of the 17 reactors, the potential "Apparent Future Consumption" for first cores alone in 1981 could have been 15.6 million pounds.

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5. In 1982, for the first time, DOE requested that utilities supply information on their inventories of fabricated fuel. The total as of January 1, 1982 is 20.4 million pounds U_3O_8 equivalent.

It is now apparent that more utilities than previously expected have first cores being fabricated. It is most unlikely that all 17 reactors on the NRC list actually will be licensed in 1983; some are shown as less than 80 percent complete as of June 30, 1982. However, for various reasons, some utilities have chosen to have first cores fabricated well in advance of certain need, accounting for a 7.9 million pound drop in commercial inventory.

This accelerated movement of enriched uranium into fabrication does not change the overall consumption of the US nuclear industry. It represents only a shift in the annual amounts, decreasing consumption in the next few years as first cores actually fabricated in 1981 and 1982 are deleted from 1983 and 1984 consumption estimates. Thus the 1981 decline in inventory does not represent a change in the uranium supply-demand imbalance which has kept pressure on spot market uranium prices. Nuexco continues to project worldwide uranium supply in excess of consumption for the rest of the decade.

THE VARIABLE TAILS ASSAY OPTION: ITS EFFECT ON NATURAL URANIUM CONSUMPTION

Discussion

The Variable Tails Assay Option (VTAO) which US DOE allows its customers holding Adjustable Fixed-Commitment (AFC) contracts, *could* theoretically increase natural uranium feed requirements by approximately eight million pounds U_3O_8 over the two-year period ending September 30, 1984 (FY83, FY84). However, in Nuexco's opinion, such a large increase will not be realized. Many of the SWUs covered under elections of 0.30 percent tails assay (TA) are intended for resale in the secondary SWU market. It is Nuexco's opinion that at least 900,000 SWUs at 0.30 percent TA [equivalent to 262,774 kg U as UF_6 (3 percent enriched)] will be resold to parties who will have either partially terminated Requirements contracts, or will be above their Requirements contract Appendix A ceilings.

Those cancellations and substitutions will eliminate an equivalent amount of enriched product [262,774 kg U as UF_6 (3 percent enriched)]. At 0.20 TA, that quantity would have required 1,131,504 SWU and 1,439,737 kg U as UF_6 natural feed material (or 3.76 million pounds U_3O_8). Thus, in Nuexco's opinion based on a very conservative projection, secondary SWU market transactions will offset almost 50 percent of the apparent increase in natural uranium feed requirements associated with the VTAO.

Calculation of VTAO's Potential Effect on Natural Uranium Consumption

Table 4 lists the quantity of SWUs specified at each of the allowed transaction tails assays, other than those at 0.20 percent U_{235}, during each year of the four-year period beginning with FY81. Each year, the total rose substantially, and the trend was toward higher tails assays.

In order to calculate the amount by which the VTAO *might* increase uranium consumption, it is necessary to compare the theoretical uranium consumption for a given enrichment at 0.20 percent U_{235} against that at a given tails assay (TA). The following example uses 0.30 percent tails assay and 3.0 percent product enrichment:

1. Feed component for 0.30 percent TA = 6.569 Kg U in UF_6 (natural) per Kg U in UF_6 (3 percent enriched).
2. SWU component for 0.30 TA = 3.425 SWU per Kg U in UF_6 (3 percent enriched).
3. Ratio of Feed component (0.30 TA) to SWU component (0.30 TA) = [6.569/3.425 = 1.918] Kg U in UF_6 (natural) per SWU.
4. Feed component for 0.20 percent TA = 5.479 Kg U in UF_6 (natural) per Kg U in UF_6 (3 percent enriched).
5. SWU component for 0.20 percent TA = 4.306 Kg U in UF_6 (natural) per Kg U in UF_6 (3 percent enriched).
6. Ratio of Feed component (0.20 TA) to SWU component (0.20 TA) = [5.479/4.306 = 1.272] Kg U in UF_6 (natural) per SWU.
7. Subtracting step 6 from step 3 yields [1.918 − 1.272 = 0.646] Kg U in UF_6 (natural) per SWU.
8. Convert to U_3O_8: 0.646 Kg U in UF_6 (natural) times 2.61284 pounds U_3O_8 per Kg U in UF_6 (natural) = 1.687 pounds U_3O_8 per SWU.

Therefore, *for a fixed quantity of SWU*, and assuming 3.0 percent enrichment, each SWU at a tails assay of 0.30 percent U_{235} would use 1.687 pounds U_3O_8 more than a SWU at 0.20 percent U_{235}. The corresponding changes in feed requirements for each of the tails assays allowed under the VTAO are listed in Table 5, along with the feed components and SWU components used to derive them.

The changes in feed requirements developed in Table 5, when multiplied by the numbers of SWUs elected in a given year at each tails assay, can be used to estimate the potential impact of the VTAO. For example:

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1. From Table 4, DOE's AFC customers elected 93,929 SWUs at 0.16 percent TA in FY81.

2. Assuming an average enrichment level of 3.0 percent, Table 5 indicates that each SWU at 0.16 percent TA would use 0.533 pounds U_3O_8 *less* than at 0.20 percent TA.

3. Thus, the algebraic product of the VTAO SWUs at 0.16 percent TA (93,929) and the corresponding multiplier (-0.533 pounds U_3O_8 per SWU) yields a *decrease* in requirements of 50,064 pounds U_3O_8.

The corresponding results for each combination of fiscal year and tails assay are shown in Table 6.

Background

USDOE has allowed holders of Adjustable Fixed-Commitment (AFC) contracts to select, commencing with deliveries scheduled for fiscal year ending September 30, 1981 (FY81), tails assays other than the 0.20 percent U_{235} at which DOE operates the enrichment plants.

The portion of the AFC contact providing for the Variable Tails Assay Option (VTAO) — Article II, Section 9 — is quoted below:

"In the event the Customer wishes to obtain during any fiscal year, commencing in Fiscal Year 1981, enriched uranium in such quantities (KgU) and assays (weight percent U_{235}) that would vary from that obtainable, pursuant to the established DOE standard table of enrichment services, from the enrichment services specified for such year in the Appendix "A", the Customer may obtain such enriched uranium by electing the variable tails assay option. Such option is available upon at least fifteen months' notice prior to the fiscal year of the election of such option and is available at least between the tails assays of 0.20 weight percent U_{235} to 0.30 weight percent U_{235}. Additional terms and conditions may be established by DOE from time to time, such as tails assays outside of the 0.20 weight percent U_{235} to 0.30 weight percent U_{235} range, charges associated with selection of such tails assays and tables of discrete tails assays other than the Standard Table for establishing the enriched product to be delivered in accordance with Appendix 'A'."

The "additional terms and conditions" established by DOE with regard to FY83 and FY84 are summarized as follows:

1. VTAO applies to tails assays of 0.16 to 0.30 percent U_{235} (at intervals of 0.01 percent).

2. Customers may allocate their contracted SWUs over any of the allowable VTAO transaction tails assays without extra charge.

Table 4

QUANTITY OF SWUs ELECTED UNDER VTAO[1]
(AT TAILS ASSAYS OTHER THAN 0.20%)

Tails Assay (Percent U_{235})	FY81	FY82	FY83	FY84	
				Domestic	Foreign
0.16	93,929	818,776	832,654	8,131	0
0.18	79,639	0	0	0	0
0.19	218,611	93,928	86,745	0	240,066
0.21	67,931	0	0	0	0
0.22	0	401,125	363,765	0	0
0.23	0	242,724	742,630	100,000	0
0.24	0	162,176	0	178,870	482,406
0.25	0	108,095	125,212	0	0
0.26	0	0	790,365	107,503	0
0.27	0	0	163,763	548,445	0
0.28	0	0	276,771	238,101	247,682
0.29	0	0	50,400	0	198,758
0.30	0	0	187,770	2,114,347	212,361
TOTAL	460,110	1,826,824	3,620,075	3,295,397	1,381,273

[1]Source: USDOE

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Table 5

DATA USED IN COMPUTING VTAO POTENTIAL EFFECTS ON FEED REQUIREMENTS

Tails Assay (& U_{235})	Feed Component[1] [kg U as UF_6 (natural) per kg U as UF_6 (3% enriched)]	SWU Component[1] [SWU per kg U as UF_6 (3% enriched)]	Change in Feed[2] Requirements, relative to 0.20% TA [pounds U_3O_8 per SWU]
0.16	5.154	4.824	0.533
0.17	5.231	4.681	0.405
0.18	5.311	4.548	0.273
0.19	5.393	4.423	0.139
0.20	5.479	4.306	0
0.21	5.569	4.196	0.143
0.22	5.662	4.092	0.291
0.23	5.759	3.994	0.443
0.24	5.860	3.900	0.601
0.25	5.965	3.811	0.765
0.26	6.075	3.727	0.934
0.27	6.190	3.646	1.111
0.28	6.311	3.569	1.296
0.29	6.437	3.495	1.488
0.30	6.569	3.425	1.687

[1]Source: USDOE

[2]Computed as follows:
Multiply 2.61284 lbs. U_3O_8 per kg U as UF_6 times [Feed-to-SWU ratio for the given TA minus Feed-to-SWU ratio for 0.20% TA]

Table 6

POTENTIAL IMPACT OF VTAO ELECTIONS
Potential Increased Feed Requirements[2]
(thousands of lbs. U_3O_8 equivalent)

Tails Assay (% U_{235})	Multiplier[1] (Additional lb. U_3O_8 per SWU)	FY81	FY82	FY83	FY84 domestic	FY84 foreign
0.16	0.533	50.1	436.4	443.8	4.3	0
0.17	0.405	0	0	0	0	0
0.18	0.273	21.7	0	0	0	0
0.19	0.139	30.3	13.1	12.1	0	33.4
0.20	0.000	0	0	0	0	0
0.21	0.143	9.7	0	0	0	0
0.22	0.291	0	116.7	105.9	0	0
0.23	0.443	0	107.5	329.0	44.3	0
0.24	0.601	0	97.5	0	107.5	289.9
0.25	0.765	0	82.7	95.8	0	0
0.26	0.934	0	0	738.2	100.4	0
0.27	1.111	0	0	181.9	609.3	0
0.28	1.296	0	0	358.7	308.6	321.0
0.29	1.488	0	0	75.0	0	295.8
0.30	1.687	0	0	316.8	3,566.9	358.3
	TOTAL:	92.4	45.1	1,745.4	4,732.7	1,231.6

[1]This Report, Table 5

[2]Derived as the product of the multiplier from column 2 and the SWU quantities listed in This Report, Table 4

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URANIUM OCCURRENCES IN NORWAY

Introduction

Known uranium mineralization in Norway is limited to occurrences widely scattered throughout the country, none of which are of sufficient size and percent U_3O_8 for commercial development at this time. The government sponsors continued uranium exploration in conjunction with programs for other minerals. However, uranium exploration programs are of low priority since Norway does not have a nuclear power program.

The government has considered a long-term power program on at least two occasions, the last being in the mid-1970s when efforts to site the first plant were terminated primarily due to a reduction in the annual growth rate for electric power. Projected demand for electrical energy remains low for Norway and the government does not anticipate a need for nuclear power during the rest of this century.

Exploration History

Norway produced small amounts of uranium in the last quarter of the 19th century. Production was a by-product from the pegmatite mines in the Telemark district of southern Norway. The principal use for the uranium oxide was a coloring agent in manufacturing certain glass products. When the pegmatite mines closed down at the turn of the century, uranium production ceased and has not resumed to this date.

Uranium exploration was initiated by the Norwegian government in the late 1940s through a joint effort of the Norwegian Defense Research Establishment (FFI), the Joint Establishment for Nuclear Energy Research (IFA) and the Geological Survey of Norway (NGU). The purpose of the program was to determine Norway's uranium resource potential for the support of a possible nuclear power program. The joint venture concentrated on known occurrences, including the pegmatite district, and the Cambrian shales in the Oslo region. The overall success of the program included the discovery of a number of small, low-grade occurrences of questionable economic potential. The program was cancelled short of the intended purpose.

The Geological Survey resumed exploration on a small scale in the mid-1950s. Vehicle-borne radiometric measurements were carried out on a systematic pattern throughout areas where the geology was considered favorable. The program apparently met with little success and was abandoned before the end of 1959.

A multi-mineral exploration program was initiated by the NGU in the 1960s. An aeromagnetic survey was completed over practically the entire country on a line spacing of 1KM. Radiometric detection equipment was added for flights over areas with potential for uranium mineralization. A number of radiometric anomalies were located during the survey, but follow-up investigations failed to generate any important uranium prospects.

The most recent uranium prospecting program in Norway was initiated by the NGU in 1975. Again, uranium exploration techniques were included as part of a much broader mineral prospecting program. The program is outlined to general prospecting and mapping for all mineral resources. Air and vehicle-borne radiometric detection equipment has been utilized from the start. Geochemical and stream sediment samples showing indications of uranium are analyzed by fluorimetric methods. Every uranium occurrence discovered is eventually investigated for its economic potential. No commercial uranium deposits have been located to date, however, important occurrences of other minerals have been recorded. The government is continuing to sponsor the program in an effort to broaden the resource base for the country.

General Geology

Precambrian crystalline rocks belonging to the Fennoskandian Shield forms the basic geology of Norway. The Precambrian is exposed in the south, east and north portions of the country. In central and northern Norway, the Precambrian is covered by Paleozoic rocks comprised of metasediments and metavolcanics of Cambrian-Silurian age, and sediments of Devonian age along the southwestern coastline. Jurassic and cretaceous sediments occur along the central coastline and on nearby islands.

The early Paleozoic formations were metamorphosed, folded and faulted during the Caledonian Orogeny dating about 400 to 600 million years. The highly disturbed rock sequence forms the Caledonian mountain chain that extends along the full length of the Swedish border and continues under the North Sea to surface again in Scotland and Ireland.

Precambrian basement rocks of the Fennoskandian Shield were structurally affected by the Caledonian Orogeny and are now exposed through tectonic/erosional "windows" that occur at random along the Caledonian mountain chain. Many uranium occurrences of Norway are found in folded rocks of the Caledonian mountains.

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particularly in the Precambrian windows. (A window is formed when a portion of surface rock has eroded away exposing underlying older rocks. The Olden Window discussed in Nuexco Report 169, page 22, is a classic example of a geologic window.)

Prospecting is made difficult by the extensive cover of glacial drift throughout central and northern Norway, especially along the more favorable Caledonian mountain front. Prospecting is initiated by utilizing a variety of radiation detection equipment in glacial areas, the most effective being till-spectrometry. Airborne and ground geophysics are used to detect surface and buried geological features that are favorable to mineralization. Once a prospect has been identified, follow-up evaluation includes detailed geophysical and geochemical work, trenching and extensive rock sampling. Core drilling is initiated only if earlier investigative work indicates considerable potential exists for a commercial ore deposit.

Uranium Occurrences

Uranium mineralization is essentially confined to the Precambrian and Cambrian-Silurian rock sequence of Norway. Mineralization in Precambrian rocks is closely associated with highly folded and metamorphosed rocks; in the Cambrian-Silurian formations, it is likely to occur along unconformable contacts with Precambrian rocks, and in overlying bituminous shales and sandstones. The mineralization probably originated as a result of hydrothermal action on extensively altered basement rock, whereby widely disseminated minerals were gradually taken into solution for later precipitation in a favorable host environment. Uranium is deposited in highly brecciated and fractured zones in Precambrian rocks, and along contact and carbonaceous zones in the shale and sandstone. It may occur in concentration along a vein or fracture surface, or disseminated throughout the favorable zone. The important uranium minerals are pitchblende and uraninite.

There are a number of known occurrences of uranium mineralization in Norway as shown in Figure 1. In most cases, however, the uranium occurs as a minor accessory mineral to one or two other minerals. Historically, the exploration and development process has been for the economic recovery of the "other" minerals. Uranium has not been produced in Norway in recent years.

One of the more interesting areas where uranium is known to occur with other minerals is located in the Komagfjord Window, near the community of Porsa in northern Norway. Precambrian rocks of the Raipas Suite are exposed in the Komagfjord Window. The NGU carried out an airborne gamma-ray survey over the area in 1975. Uranium mineralization was discovered during a ground check in two old mines of the Porsa-Neverfjord copper district. Uranium was found in the Bachkes and Bahrs mines which are situated about two kilometers apart. Uranium has not been found in other copper mines within the district.

The uranium mineralization is restricted to a definite geologic zone in each mine. At the Bachkes mine, pitchblende occurs in association with copper and iron sulfides and a host of gangue minerals. Secondary copper, iron and uranium occur in highly altered rock. The main host rock is massive and well altered basaltic pillow lavas (greenstone) overlain by a dolomite/limestone sequence. All rock types have undergone metamorphism. The minerals formed in a highly fractured rock segment, probably as a result of hydrothermal activity. The uranium content of select samples taken from the mine averaged 0.40% U_3O_8. The highest assay recorded was 1.00% U_3O_8.

Uranium mineralization in the Bahrs mine occurs in the same rock-type. The uranium mineral is brannerite and it contains traces of lead, iron, chromium and nickel. The brannerite occurs as an intergrowth with rutile. The suite of commercial sulfide minerals and the gangue minerals is like that at the Bachkes mine. The uranium content of ore samples averaged only 0.10% U_3O_8.

The source of the uranium is thought to be from the bituminous shales which overlie the metamorphosed rocks. The shales contain an average of 10 ppm uranium. The uranium was taken into solution by descending hydrothermal solutions and deposited among the altered and fractured rock. It was later remobilized to form an integral part of existing ore deposits. The uranium occurs in small amounts and is not of commercial interest; however, the immediate vicinity is favorable for additional uranium and more exploration is needed.

Most of the remaining uranium shows are related to the pegmatites of the Iveland and Evje districts in southern Norway, and the Precambrian granites of the Telemark-Oslo region which contain higher than normal concentrations of uranium. Three separate granite intrusions extending northwest through the Oslo region for a distance of about 300 Km are known to contain from 5 to 10 ppm uranium. The potential for a low grade, large tonnage deposit of uranium exists throughout the region.

The Cambrian bituminous shales also have an abnormally high uranium content of about 110 ppm U_3O_8.

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The shales cover hundreds of square kilometers in the Oslo region, so the potential exists for the discovery of important mineralization within the shale district. Additional evaluation work is required for the shale zones.

The graphitic schists located near Holandsfjord in central Norway contain 40 to 160 ppm U_3O_8. The occurrence has perhaps the highest potential for a uranium mining and recovery project in the country due to favorable geology and mode of occurrence. However, the potential of the mineralization has not been fully evaluated. It seems likely that additional uranium will be discovered in the graphitic environment.

The overall potential for the discovery of commercial uranium presources in Norway is only moderate. Geologically, the Norwegian portion of the Fennoskandian Shield, separated from Sweden by the Caledonian mountains, has considerably fewer ore deposits of economic importance than does the shield area of Sweden and Finland. The potential for important uranium deposits is lessened accordingly.

Figure 1

URANIUM OCCURRENCES IN NORWAY
Numbered Occurrences Described in Text

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STATISTICAL DATA

EXCHANGE VALUE $17.00/lb. U_3O_8
Determined as of September 30, 1982

Definition[1]

The Exchange Value is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the last day of the month.

Derivation

Nuexco bases the Exchange Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

Comments

Nuexco does not consider the following in determining the Exchange Value:

A. The price of uranium delivered or to be delivered under old contracts.
B. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.

[1]In December, 1981, Nuexco published a history of the Exchange Value which chronicled, month-by-month, changes in its definition, usage and derivation. Copies are available upon request.

TRANSACTION VALUE[2]
Determined as of September 30, 1982

$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
17.30	3.2	16	3

Definition

The Transaction Value is a weighted average price of recent transactions, and is based on prices paid for U_3O_8 in transactions closed within the previous three-month period and for which delivery was scheduled within one year of the transaction date. At least ten transactions totaling at least two million pounds U_3O_8 are included in each calculation, or the sample time is extended as necessary to include these minima. Foreign currencies are converted to US dollars as of the transaction date.

[2]Transaction Values for 1976 through 1981 and their associated parameters (millions of pounds, number of transactions and number of months) are tabulated on pages 31 and 32 of Report 161.

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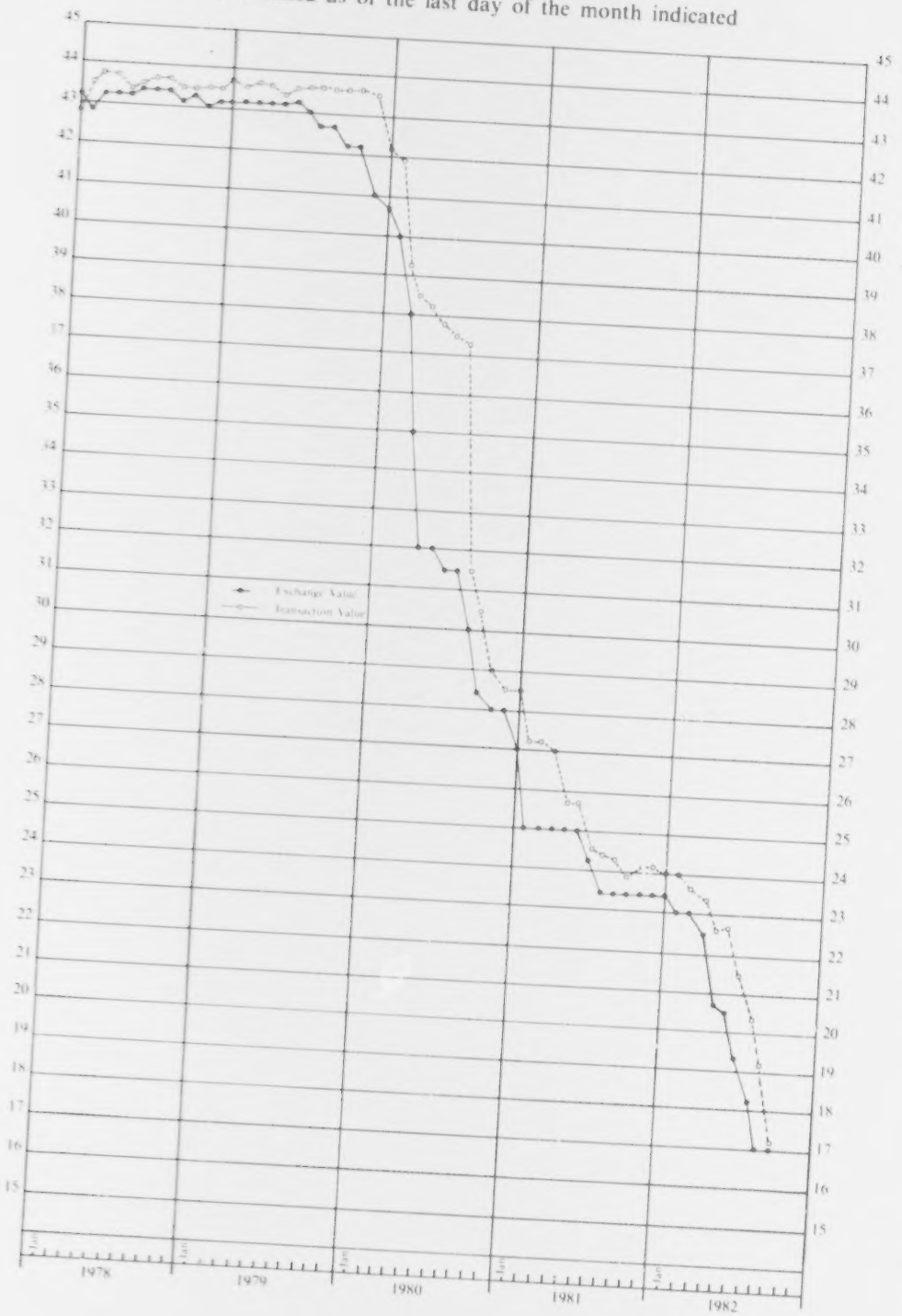
EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1978

Determined as of the last day of the month indicated



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STATISTICAL DATA

HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00			

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30			

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country	per lb. U_3O_8 in Concentrates	per kg U_3O_8 in Concentrates	per kg U in Concentrates
US (dollar)	17.00	37.48	44.20
France (franc)	121.34	267.51	315.46
FRG (mark)	42.89	94.55	111.49
Japan (yen)	4,556	10,045	11,846
Switzerland (franc)	36.84	81.21	95.77
UK (pound)	10.00	22.05	26.01
Australia (dollar)	17.89	39.43	46.50
Canada (dollar)	20.96	46.22	54.50
Niger, Gabon (CFA)	6,071	13,385	15,784
South Africa (rand)	19.60	43.20	50.95
Sweden (kroner)	106.78	235.42	277.61

[1]Calculated using currency exchange rates published in the Wall Street Journal on the last business day of the month.

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STATISTICAL DATA

CONVERSION VALUE $1.10/lb. U as UF_6
Determined as of September 30, 1982

Definition

The Conversion Value is Nuexco's judgment of the price at which spot and/or near term transactions for significant quantities of conversion services could be concluded in the secondary market as of the last day of the month.

Derivation

Nuexco bases the Conversion Value upon:
A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

Comments

Nuexco does not consider the following in determining the Conversion Value:
A. The price of conversion services delivered or to be delivered under old contracts.
B. The price of conversion services delivered in connection with contract renegotiations or other than arm's length transactions.

LOAN USE CHARGE RATE[1] 6%
Determined as of September 30, 1982

Definition

The Loan Use Charge Rate is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the last day of the month.

Derivation

Nuexco bases the Loan Use Charge Rate upon:
A. Data from recently completed or pending loan transactions.
B. Rates included in firm proposals to borrow or lend.
C. Rates that potential borrowers and lenders have expressed as a willingness to pay or accept, but for which Nuexco is not aware of firm proposals.

[1]Monthly data for 1968 through 1981 appear on pages 32-34 of Report 162.

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STATISTICAL DATA

AUSTRALIAN GOVERNMENT STATISTICS

	Price Index of Materials Used in Manufacturing Industry—All Groups (Year 1968-69 = 100.0)[1]	Weighted Average Minimum Weekly Wage Rates—Adult Males Australia Mining and Quarrying (A$)[2]
Annual Avg. 1971[3]	101.5	65.95
Annual Avg. 1972[3]	105.6	71.26
Annual Avg. 1973[3]	124.4	78.96
Annual Avg. 1974[3]	141.9	108.07
Annual Avg. 1975[3]	150.4	132.55
Annual Avg. 1976[3]	168.4	160.93
Annual Avg. 1977[3]	192.0	179.03
Annual Avg. 1978[3]	198.5	190.04
Annual Avg. 1979	248.8	196.34
Annual Avg. 1980	321.8	218.00
Annual Avg. 1981	355.3	237.34R
Apr 1981	354.6	229.38
May 1981	353.4	237.31
Jun 1981	360.4	237.93
Jul 1981	356.9	237.86
Aug 1981	359.9	237.86
Sep 1981	357.4	238.00R
Oct 1981	351.6	239.26
Nov 1981	351.3	241.31R
Dec 1981	349.9	258.56R
Jan 1982	354.9	261.58R
Feb 1982	356.7	262.95R
Mar 1982	360.3	263.12R
Apr 1982	368.1	262.99R
May 1982	367.9	263.24R
Jun 1982	367.6P	264.19R
Jul 1982	369.5P	268.20

P = Preliminary R = Revised since last month

[1]Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0), Table 3.
[2]Australian Bureau of Statistics, Canberra: "Wage Rates, Australia" (Catalogue No. 6312.0), Table 1. Figures for the latest fourteen months shown are subject to revision.
[3]Monthly data for 1970 through 1978 appear on pages 4.7 and 4.8 of Nuexco Report 138.

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STATISTICAL DATA

CANADIAN GOVERNMENT STATISTICS

	Industry Selling Price Index: Manufacturing (D 500000)[1] [2] (1971 = 100.0)	Wage-earner Data: Average Hourly Earnings (C$)[3] [4]		
		Metal Mining, including Milling (SIC 050-059)	Primary Metal Industries, non-ferrous (SIC 296-298)	Chemicals and Chemical Products (SIC 370-379)
Annual Avg. 1978	190.4	8.76	6.82	6.97
Annual Avg. 1979	217.9	9.60	7.35	7.67
Annual Avg. 1980	247.2	10.59	8.05	8.50
Annual Avg. 1981	272.3P	12.02	9.03	9.53
Jul 1981	274.3	11.92	9.20	9.62
Aug 1981	276.2	11.83	9.15	9.63
Sep 1981	276.9	12.47	9.22	9.77
Oct 1981	279.3	12.78	9.35	9.91
Nov 1981	278.8	12.89	9.45	9.89
Dec 1981	280.0	12.87R	9.42	10.03
Jan 1982	281.9	13.14R	9.53	10.11
Feb 1982	283.4	13.25R	9.60	10.19
Mar 1982	284.6	13.34R	9.62	10.35
Apr 1982	287.4	13.46R	9.79	10.48
May 1982	288.8R	13.64P	9.88P	10.52P
Jun 1982	289.8P	13.47P	9.99P	10.68P
Jul 1982	290.5	—	—	—
Aug 1982	290.2	—	—	—

P = Preliminary R = Revised since last month

[1]Statistics Canada, Prices Division, Ottawa; "Industry Price Indexes" (Catalogue 62-011), Table 1. Indexes for the most recent six months shown are subject to revision.

[2]Monthly data for 1973 through 1978 appear on page 4.13 of Nuexco Report 138.

[3]Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa; "Employment, Earnings and Hours" (Catalogue 72-002), Table 2.

[4]Monthly data for 1977 and 1978 appear on page 4.11 of Nuexco Report 138.

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STATISTICAL DATA

REPUBLIC OF SOUTH AFRICA STATISTICS

	Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Consumer Price Index[2] (1975 = 100, except where otherwise indicated)	Wholesale Price Index All Groups (1975 = 100)	Total Employment in Mining and Quarrying (Code 35)[5]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[5]
Annual Avg. 1971[3]	7.88	106.4[4]	59.1	652,294	415,956
Annual Avg. 1972[3]	8.79	113.3[4]	63.9	623,067	443,933
Annual Avg. 1973[3]	10.51	124.1[4]	72.3	684,743	572,133
Annual Avg. 1974[3]	13.18	138.5[4]	85.3	674,140	761,596
Annual Avg. 1975[3]	16.71	157.2[4]	100.0	639,473	1,003,617
Annual Avg. 1976[3]	19.30	174.7[4]	115.1	671,240	1,212,983
Annual Avg. 1977[3,6]	23.87	194.4[4]	130.0	712,006	1,420,670
Annual Avg. 1978[3,6]	27.14	137.2	142.7	664,571	1,537,169
Annual Avg. 1979[3,6]	30.18	155.3	164.5	692,209	1,830,632
Annual Avg. 1980[6]	35.53	176.7	192.1	714,379	2,279,615
Annual Avg. 1981	41.89	203.5	218.3	728,506	2,820,505
Mar 1981	39.26	195.2	209.9	705,010	210,151
Apr 1981	—	196.4	211.6	719,674	217,124
May 1981	—	197.7	213.2	726,869	219,880
Jun 1981	40.41	200.0	215.3	728,506	237,049
Jul 1981	—	204.6	218.4	735,839	249,080
Aug 1981	—	208.0	222.6	722,684	245,817
Sep 1981	43.28	211.6	224.6	724,604	251,502
Oct 1981	—	213.4R	227.9	717,918	248,159
Nov 1981	—	214.8	229.4	720,255	253,044
Dec 1981	44.52	216.3	230.4	709,612	257,655
Jan 1982	—	217.6	233.1	700,375	257,173
Feb 1982	—	220.2	236.8	705,992	250,191
Mar 1982	45.49	225.2	237.4	725,700	262,210
Apr 1982	—	228.9	241.9	707,502	252,562
May 1982	—	230.3	244.8	715,162	258,770
Jun 1982	45.77	232.1	246.7	707,552	261,361
Jul 1982	—	234.1	249.4	—	—
Aug 1982	—	236.8	—	—	—

[1]Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly.
[2]Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."
[3]Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 4.9 of Nuexco Report 140.
[4]April 1970 = 100.00.
[5]Bulletin of Statistics, Department of Statistics, Pretoria.
[6]Historical data for Codes 35 and 40 1977-1980 appear on page 28 of Nuexco Report 157.

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STATISTICAL DATA

US GOVERNMENT STATISTICS

	Producer Price Index—Industrial Commodities (1967 = 100)[1]	Producer Price Index—All Commodities (1967 = 100)[1]	Consumer Price Index (1967 = 100)[2]	GNP Implicit Price Deflator (1972 = 100)[3]	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4]			
					Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
Annual Avg. 1971[5]	114.1	114.0	121.3	96.02	4.12	4.15	3.97	3.49
Annual Avg. 1972[5]	117.9	119.1	125.3	100.00	4.56	4.59	4.26	3.71
Annual Avg. 1973[5]	125.9	134.7	133.1	105.80	4.84	4.98	4.51	3.91
Annual Avg. 1974[5]	153.8	160.1	147.7	116.02	5.44	5.63	4.88	4.21
Annual Avg. 1975[5]	171.5	174.9	161.2	127.15	6.13	6.24	5.39	4.64
Annual Avg. 1976[5]	182.4	183.0	170.5	133.71	6.76	6.87	5.91	4.96
Annual Avg. 1977[5]	195.1	194.2	181.5	141.70	7.28	7.67	6.43	5.39
Annual Avg. 1978[5]	209.4	209.3	195.4	152.05	8.23	8.56	7.02	5.82
Annual Avg. 1979[5]	236.5	235.6	217.4	165.46	9.27	9.50	7.60	6.32
Annual Avg. 1980[5]	274.8	268.8	246.8	177.36	10.27	10.63	8.30	6.95
Annual Avg. 1981	304.1	293.4	272.4	193.71	11.55	11.98	9.12	7.62
Sep 1981	307.4	295.7	279.3	195.61	12.10	12.70	9.38	7.75
Oct 1981	309.0	296.1	279.9	—	12.08	12.44	9.37	7.80
Nov 1981	309.3	295.9	280.7	—	12.12	12.48	9.42	7.83
Dec 1981	310.0	295.8	281.5	200.10	12.08	12.45	9.53	7.90
Jan 1982	311.8	298.3	282.5	—	12.19F	12.66F	9.68	8.02R
Feb 1982	311.6	298.6	283.4	—	12.22F	12.61F	9.68	8.09R
Mar 1982	311.0	298.0F	283.1	203.68	12.29	12.69	9.71	8.01
Apr 1982	309.9	297.9P	284.3	—	12.23	12.68	9.81	8.03
May 1982	309.5P	298.6P	287.1	—	12.25	12.71	9.83	8.05
Jun 1982	310.7P	299.4P	290.6	205.98P	12.26	12.91	9.95	8.09
Jul 1982	313.0P	300.6P	292.2	—	12.24P	12.93P[6]	10.01P	8.18P
Aug 1982	313.4P	300.4P	292.8	—	—	—	10.01P	8.25P

P = Preliminary R = Revised since last month F = Final

[1]US Bureau of Labor Statistics, Washington, D.C.; "Producer Prices and Price Indexes," Table 6 (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.

[2]US Bureau of Labor Statistics, Washington, D.C.; Consumer Price Index for All Urban Consumers, US City Average, All Items.

[3]US Department of Commerce, Washington, D.C.; Bureau of Economic Analysis, National Income and Wealth Division; "Survey of Current Business," Table A. The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.

[4]US Bureau of Labor Statistics, Washington, D.C.; "Employment and Earnings," Table C-2. All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.

[5]Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Nuexco Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Nuexco Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Nuexco Report 154.
Monthly data 1979-1980 for Employment and Earnings, Revised Establishment Data, all listed codes, appear on page 22 of Nuexco Report 158.
Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.

[6]Primary Non-Ferrous Metals (SIC 333) for July 1982 was incorrectly printed in Nuexco Report 169 as 11.42

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FIGURES OF THE MONTH

	This Month	Last Month	12 Months Ago
	(Referenced to September 30, 1982)		
Exchange Value[1]	17.00	17.00	23.50
Transaction Value[1]	17.30	19.10	23.90
Conversion Value[2]	1.10	0.90	1.10
Loan Use Charge Rate[3]	6%	6%	5½%
Near-Term Uranium Supply[4]	3.3	1.7	7.4
Near-Term Uranium Demand[5]	0.66	0.16	2.4
Near-Term Supply-Demand Ratio	5.0	10.6	3.1
Optimum Tails Assay[6]	.346	.341	.287
Current Transactions[7]:			
Number of Transactions	7	10	5
Quantity of Material[8]	0.8-2.0	2.2-4.4	6.1-10.4

[1]US $ per pound U_3O_8 equivalent
[2]US $ per pound U as UF_6
[3]Per annum
[4]Active inquiries to sell, for delivery within 12 months after contract signing (millions of pounds U_3O_8)
[5]Active inquiries to purchase, for delivery within 12 months after contract signing (millions of pounds U_3O_8)
[6]Percent U_{235}. Theoretical calculation based on Exchange Value, Conversion Value, and the USDOE price for separative work under AEC contracts.
[7]Uranium transactions only; does not include loans or conversion transactions.
[8]Millions of pounds U_3O_8, equivalent.

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NUEXCO REPORT 170
EXECUTIVE SUMMARY

Exchange Value Unchanged at $17.00

The **Exchange Value** as of September 30, 1982 is $17.00 per pound U_3O_8. The spot/near-term markets were unusually active for the fourth consecutive month.

Near-term Supply and Demand Both Increased Significantly

Active sellers in the zero to one year time frame are offering 3.3 million pounds U_3O_8, up from 1.7 million pounds last month. *Active* uranium demand in the zero to one year time frame increased sharply, to 660 thousand pounds U_3O_8.

Near-term Supply-Demand Imbalance Eased

The ratio of near-term supply to near-term demand dropped to 5.0:1 this month.

Transaction Value Declined $1.80 to $17.30

The **Transaction Value** as of August 31, 1982 is $17.30 per pound U_3O_8. It includes 16 transactions totaling 3.2 million pounds U_3O_8 and covers a period of three months.

Seven Uranium Sales

Seven uranium sales are reported this month. The total quantity falls in the range of 0.8 million to 2.0 million pounds U_3O_8.

Conversion Value Rose Twenty Cents to $1.10

The **Conversion Value** as of September 30, 1982 is $1.10 per pound U as UF_6, up twenty cents from last month. Two conversion transactions are reported. Active sellers are offering 1.8 million pounds U as UF_6 in near-term conversion services, while active demand amounts to only one hundred thousand pounds UF_6.

Africa

Combined output from Rand Mines' Blyvooruitzicht and Harmony operations increased slightly in the year ended June 30, 1982 to 1,876,000 pounds U_3O_8.

Australia

Developers of Beverley deposit in South Australia plan to install pilot plant next year to test in situ leach techniques.

Canada

A major topic of discussion in Canada is US embargo legislation and its potential impact on Canadian producers.

Europe

In the **Federal Republic of Germany** (FRG), a stricter power plant emissions standard could increase pressure to build and license new nuclear units.

The Uranium Institute held its annual symposium in London. Excerpts of some of the most relevant speeches are presented.

United States

1. Sohio—Reserve settlement left Sohio with Ambar mine, Seboyeta mill, U_3O_8 inventory, some of Reserve's debts.

2. South Carolina Electric & Gas began loading fuel for its Summer nuclear unit.

Commentary

The prospects for enactment of a US uranium import embargo remain highly uncertain.

Essay

The continuing viability of the US uranium production industry is essential to US utilities' desire for assured future supplies of *domestic* uranium. If market participants can learn enough from the painful lessons of the industry's first two price cycles, it should be possible to avoid over-contracting and, in so doing, reduce the likelihood of still another cycle of boom and bust.

Market Analysis

1. The *Market Analysis* section resolves the apparent conflict between DOE data that indicated US utilities' inventories declined during 1981, and the fact that the US produced much more uranium than it consumed.

2. The Variable Tails Assay Option does not raise uranium demand as much as it might appear. In fact, secondary swu market transactions will offset at least half of the apparent increase.

Raw Materials

Describes uranium occurrences in Norway.

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